Form ESA-B4. Summary Report for ESA-253-3
Public Report - Final

Company	Madison Paper	**ESA Dates**	12/2/2008 – 12/4/2008
Plant	Madison	**ESA Type**	Steam
Product	Magazine Paper	**ESA Specialist**	Michael B. Muller

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction:

The Myllykoski Madison Paper Mill, located in Madison, Maine, produces light weight printing papers. They operate one paper machine year round and produce their own groundwood onsite.

Objective of ESA:

To help plant personnel identify and evaluate energy saving opportunities for potential waste heat recovery, maintenance adjustments, equipment improvements and optimization of the overall steam system operation.

Focus of Assessment:

The primary areas of focus were the onsite steam-based electrical generation, waste heat recovery, maintenance improvements, and system optimization, while considering regulation requirements for fuel oil boiler operation, fuel cost volatility, and limitations on various types and availability of fuel.

Approach for ESA:

The DOE Steam System Assessment Tool (SSAT) was used to create steam system models for the various areas of interest, from which ideal operational conditions were developed and evaluated. For electrical generation, several models were created to simulate the various price points for electrical and fuel costs to determine the most cost effective operation throughout the year.

General Observations of Potential Opportunities:

Steam is produced with 3 boilers fueled by #6 fuel oil, two of which use high sulfur, while the youngest uses low sulfur. (Natural gas is and will continue to be unavailable in the area.) This is an issue, primarily, for the largest boiler, which has substantial fouling issues relating to its age and fuel type.

Steam is supplied to the groundwood mill, paper machine and supplemental equipment. The groundwood mill is located about a mile from the primary plant, with the steam supplied through a pipe run along the railroad tracks connecting two locations.

Near Term Opportunities

- Shift Steam Flow from PRV to Steam Turbine

  The 220# to 40# pressure reducing valve (PRV) handles 16-20 klb/hr of steam. The steam turbine, which also runs between these pressure headers, currently runs at 90 klb/hr, despite having a maximum design capacity of 120 klb/hr. Historically, pressure control issues in the 40# header required the high PRV flow for stabilization. However, improvements, repairs, and upgrades to the pressure controls and valves have substantially reduced the need for the extra flow. Shifting a conservative 10 klb/hr of the steam flow from the PRV to the back-pressure steam turbine would result in an increase in electrical generation of almost 500 kW. While there is a slight increase in fuel costs associated with the adjusted steam requirements, the estimated annual savings would be significant and payback in less than one year. The implementation costs would be minimal, primarily resulting from modifying control programming and operation.

- Savings per year: Significant
- Implementation Cost: Minimal

- Reduce Groundwood Mill Steam Pressure

The groundwood mill steam line (feeding the PGW/Drum) provides a yearly average of 10 klb/hr of steam from the 220# header. The pressure is reduced and transferred through the steam line at 125 psig. Given the steam requirements, the PGW could instead be provided steam from the 40# header, allowing for the steam to first be used by the back-pressure turbine. For brief periods of increased steam requirements, such as cold startups, the steam could temporarily be switched back to feed off of the 220# header. While this would require a slight increase in the mass flow of steam to meet heating requirements at the lower pressures, the turbine would generate an additional 500 kW.

- Savings per year: Significant
- Implementation Cost: $40,000

- Increase Steam Trap and Leak Maintenance

Steam trap failures and steam leaks appear to be creating significant inefficiencies within the steam system and its associated costs. Implementing more intensive maintenance and preventative maintenance programs will identify and address these efficiency opportunities. The estimated steam losses based on steam trap failure and leak models are approximately 1.5 klb/hr of steam (or 130,000 gals/yr of fuel oil) through the system.

- Savings: Significant
- Implementation Cost: $35,000 (based on survey and repair/replacement estimate)

Medium Term Opportunities

- Preheat Makeup Water with Effluent Waste Water

The effluent waste water is sent to the treatment plant at an average of 105°F throughout the year. For the 7 winter months, this effluent could be used to preheat facility makeup water. While maintaining the waste treatment plant's operational requirements, the effluent could potentially be cooled to 80°F or lower. Based on a flow rate of 2,000 gpm, this would offset 72 MMBtu/day of steam preheating. While the makeup water is also preheated with waste heat in the hood, the effluent waste heat will not increase the makeup water temperature enough to significantly affect the performance of the hood exhaust heat exchanger. Therefore, this energy recovery will only offset steam preheating requirements.

- Savings per year: Significant
- Implementation Cost: $350,000

Long Term Opportunities

- Increase Turbine Inlet Steam Temperature

The turbine inlet temperature averages 450°F, while it has a design temperature of almost 492°F. This reduces the potential generation by approximately 700 kW. The following steps would be required to increase the steam temperature:

- Increase boiler super heater temperatures – requiring additional fuel
- Increase boiler #4 steam production – requiring additional maintenance
- Redirect lower temperature boiler steam to PRV and groundwood mill, while sending the high temperature boiler steam to turbine – requiring additional valves, controls and piping

Based on the increase generation, maintenance, and fuel costs associated with increased turbine inlet temperature:

- Savings per year: Significant
- Implementation Cost: $200,000 to $500,000 (depending on actual boiler/super heater operational requirements)

- Reduce Groundwood Mill Steam Demand

The groundwood mill has several stones requiring constant hot water lubrication for operation. This water is heated with sparged steam and used for only one pass and disposed of without any waste heat recovery. Particle filters could be used to recover and reuse a substantial portion of this water flow. As the stone costs are significant, serious care is required in the installation and maintenance of this water cycling system, to assure it does not adversely affect the equipment. The savings would result from the reduction in steam required for preheating this project would have a 3 year payback on energy savings. Water cost savings would be minimal.

  - Savings per year: Significant
  - Implementation Cost: $400,000 to $600,000

- Install a Biomass Boiler

The boilers are reaching the end of their current life cycle. The best option appears to be the installation of a biomass boiler, fueled primarily by bark and wood chips. Several major reasons supporting this option include:

  - Significant overhauls or rebuilds would trigger a new set of operational restrictions on fuels and emissions.
  - Wood fuel prices have a comparatively low level of volatility compared to fuel oil
  - An existing fuel oil boiler could be used to stabilize steam production
  - Wood fuel is unlikely to ever be more expensive, even with steam generation inefficiencies, compared with fuel oil
  - Production costs are already heavily and permanently linked to wood costs
  - Biomass (wood) is a carbon neutral fuel!
  - Potential for future green generation credits

The biomass boiler would ideally provide 492°F 220 psig steam at a rate of 100 klb/hr. This increased, more energized flow of steam would allow the turbine to potentially generate an additional 640 kW. Onsite bark would provide 60% of the fuel requirement with 40% supplemented by wood chips. Overall, 70% of the steam energy would be provided by wood fuel, with 30% being provided by fuel oil. Based on the impact this would have on the overall model of the plant steam system, this would result in a cost savings of:

  - Savings per year: $5,800,000
  - Implementation Cost: $36,000,000

Additional Opportunities:

- Improve Condensate Return Rate on 40# Header

The condensate return rate for 40# steam is estimated at about 90%. Several small opportunities exists to recovery some additional condensate. The estimated savings for recovery of an additional 1% is $16,000 per year.

- Evaluate Groundwood Mill Piping Heat Losses

The groundwood mill is supplied steam from a one mile long, above ground, steam pipe. There is no current instrumentation in place to evaluate and track heat and steam losses in this pipe. Given the potential significant losses that could occur, tracking these losses could provide a baseline for a more substantial maintenance budget, as well as, allowing for the quick identification of problems with the pipe that could easily go unnoticed otherwise.

Natural Gas Savings

Near term: 0%
Medium term: 0%
Long term: 0%
Total: 0%

Electricity Savings

Near term: 2.15%
Medium term: 0%
Long term: 2.15%
Total: 4.3%

Management Support and Comments:

MYLLYKOSKI is known as a pioneer in using new technologies as well as recycled fibers for paper production. All European mills are certified with the environmental management System ISO 14001. MYLLYKOSKI's vision is to be the premier publication paper brand recognized for creativity and positive business solutions.

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